8.8 WATER RESOURCES

8.8.1 Affected Environment

Climate

The climate at PTA is classified as cool and tropical (upper montane to alpine). Figure 8-20 shows the average annual rainfall contours over the island of Hawai'i. The 29-year average annual precipitation at BAAF on the northern portion of the installation is 14.7 in (37.3 centimeters), ranging from 10 to 16 in (25 to 41 centimeters) across the installation. Most of PTA is above the thermal inversion layer and is not influenced by the trade wind-orographic rainfall regime. Moisture carried by the summer easterly trade winds is lost as precipitation with an increase in elevation and rarely reaches PTA (USARHAW and 25th ID[L] 2001b).

The highest monthly precipitation generally occurs in winter in conjunction with Kona storms. Occasionally, moist air trapped below the inversion layer will rise into the Saddle Region in the later afternoon. Precipitation from condensation then can occur and may equal that from rainfall. The area is also subject to "vog," a local term used to describe "foggy" or "smoggy" conditions caused by emissions of volcanic dust and gases such as hydrogen sulfide that mix with atmospheric moisture to form a cloud close to the ground that can affect respiration and health (USARHAW and 25th ID[L] 2001b; USGS 2000a).

The annual average temperature is about 60° Fahrenheit (16° Celsius) in lower elevations and about 50° Fahrenheit (10° Celsius) at higher elevations. Diurnal temperature fluctuations are greater than the seasonal variations (USARHAW and 25th ID[L] 2001b).

Surface Water

Surface Water Drainage

Figure 8-21 shows the watersheds and principal drainage features at PTA. PTA lies within the Northwest Mauna Loa and the West Mauna Kea watersheds, which drain to the northern Hualālai and southern Kohala coasts, respectively (Mink and Lau 1993). The WPAA and the PTA Trail are mainly within the West Mauna Kea watershed. The two watersheds are underlain by aquifer "sectors" of the same name.

There are no surface streams, lakes, or other bodies of water within PTA boundaries due to low rainfall, porous soils, and lava substrates. There are no perennial streams within 15 miles (24 kilometers) of PTA. However, there are at least seven intermittent streams that drain surface water off the southwestern flank of Mauna Kea and lie within the same drainage area as the PTA. Popo's Gulch is the closest stream to PTA boundaries. The stream converges with 'Auwaiakeakua Gulch to drain surface water toward the Waikoloa community to the west of PTA. There are three intermittent streams located within two miles (3 kilometers) of the cantonment area (Waikahalulu Gulch, Pōhakuloa Gulch, and an unnamed gulch, which collect runoff from the southern flank of Mauna Kea) (USACE 1997).

Figure 8-20
Average Annual Precipitation

Figure 8-21
Watershed Boundaries and Drainage Features on Pōhakuloa Training Area

Intermittent stream channels quickly dry after rainfall stops. Rainfall, fog drip, and occasional frost are the main sources of water that sustain plants and animals in the dryland habitat of PTA and WPAA. Lake Waiau, near the summit of Mauna Kea, is the nearest known surface water body. There are three freshwater springs in Pōhakuloa Gulch, on the slope of Mauna Kea at 8,850 feet (2,697 meters) above mean sea level, known as Hōkūpani Spring, Waihū Spring, and Liloe Spring (USARHAW and 25th ID[L] 2001b; 1996). The springs are owned by the State of Hawai'i, but the Army has nonexclusive rights to the springs through a formal lease agreement (see Section 8.14 for more details). The water yield from the springs varies seasonally depending on precipitation on Mauna Kea. Daily yield reportedly ranges from about 6,000 gallons (22,712 liters) to 100,000 gallons (378,541 liters) (USARHAW and 25th ID[L] 1996). Due to past problems with the sand filtration system used to treat the water, the springs are not currently used to supply potable water to PTA, and all of the water used at PTA is trucked in.

Flooding

The cantonment and airfield areas of PTA, north of Saddle Road, are on land that slopes gently to the west. Under some circumstances, the runoff from the south slope of Mauna Kea could exceed the drainage capacity of the area and result in temporary flooding or localized ponding. However, the soils in the area are permeable, and the underlying lava flows contain sufficient secondary permeability (fractures and large openings related to cooling and emplacement of the lava) that infiltration to the subsurface is rapid.

The civil defense tsunami evacuation map in the area of Kawaihae Harbor shows the evacuation area as extending inland beyond the Kawaihae-Mahukona Road (Highway 270) to an elevation of about 50 feet (15 meters) msl (PDC 2001, Map 10). The area west of the highway and north of the road to Spencer Beach Park, including the harbor, lies within the evacuation zone.

Surface Water Quality

According to Hawai'i's 1998 305(b) report, most of the state's water bodies have variable water quality that declines when stormwater runoff carries pollutants into surface waters. The most significant surface water pollution problems in Hawai'i are siltation, turbidity, nutrients, organic enrichment, toxins, pathogens, and pH from nonpoint sources, including agriculture and urban runoff (USEPA 1998). Few data on surface water quality are available for the PTA watersheds. As stated above, there are no perennial streams within PTA. Waikoloa Stream flows across Mauna Kea near the northern boundary of the West Mauna Kea watershed (described below). According to the US EPA 305(b) list, Waikoloa Stream water quality is impaired, although not threatened, due to the presence of nutrients (nitrogen- and phosphorous-containing compounds), pathogens (coliform bacteria), and turbidity (USEPA 2000c).

Coast Water Quality

Marine waters north of Wai'ula'ula Point are considered to be Class A waters, rather than Class AA. As described above, Pelekane Bay is considered to be an impaired waterbody due to turbidity from erosion on overgrazed lands in the watershed above it.

Construction of the Kawaihae Harbor in 1995 resulted in changes in coastal current patterns, increased sediment concentrations, and diverted stream channels that discharge to Kawaihae Bay (Makahuna and Makeāhua streams). Construction involved placing fill on the alluvial fan of the Makahuna Stream and disturbing offshore sediments. The breakwater was constructed in such a way as to make use of the existing coral reef, and the area inside the reef/breakwater was deepened by dredging. Studies performed afterward that focused on Pelekane Bay, just south of the new facility, indicated that these activities had an adverse impact on coral growth and water quality, in part because of changes in sediment inputs (Tissot 1998).

Groundwater

Groundwater Occurrence and Flow

Rainfall is the primary source of groundwater recharge on the island of Hawai'i. The geology of the island is characterized by highly permeable lavas from which little or no runoff occurs. These lavas are exposed over about five-sixths of the surface of the island. Most of the rain falling onto the island percolates relatively quickly to the underlying groundwater body and then moves seaward, discharging into the coastal waters (Stearns and MacDonald 1946). The island of Hawai'i has the highest recharge rate among the Hawaiian Islands, with a rate of 188.4 cubic meters per second (Lau 1983). Sustainable yields for each of the island's aquifers are considerably less and are described below for each aquifer system underlying PTA.

According to the classification scheme proposed by Mink and Lau (1993), PTA lies above two aquifer systems—the Northwest Mauna Loa Sector and the West Mauna Kea aquifer sectors. The northern portion of PTA and PTA Trail lie within the Waimea aquifer system of the West Mauna Kea aquifer sector. The Waimea aquifer system includes the entire West Mauna Kea aquifer sector, which has an area of 270 square miles (699.25 sq kilometers). The southern boundary from Puakō Point to the Humu'ula Saddle is the trace of the Mauna Loa/Mauna Kea geologic contact. The northern boundary from Kawaihae to Waimea follows the Mauna Kea/Kohala contact. From Waimea the boundary strikes southeasterly along a weak rift zone to the summit of Mauna Kea (Mink and Lau 1993).

The West Mauna Kea aquifer system is dry, but Waikoloa Stream, which rises in the Kohala Mountains, flows across Mauna Kea lavas near the northern boundary. A basal lens reaches to about 4 miles (6 kilometers) inland. Beyond this point the water becomes high-level groundwater, although the mode of occurrence is not understood. Wells at about 1,200 feet (366 meters) elevation develop freshwater. Near Waiki'i and Waimea the groundwater level stands about 1,500 feet (457 meters) above sea level. Slightly thermal basal water is found along the Kawaihae to Waimea road below an elevation of 1,000 feet (305 meters). At the coast, basal springs discharge brackish water (Mink and Lau 1993). The Waimea aquifer system has an estimated sustainable yield of approximately 24 MGD (HDLNR 1995).

The majority of PTA lies within the Northwest Mauna Loa aquifer sector, which has an estimated sustainable yield of 30 MGD (HDLNR 1995). The 'Anaeho'omalu aquifer system comprises the entire Northwest Mauna Loa aquifer sector and has a total area of 291 square miles (754 square kilometers). The sector boundaries reach from the 7-mile (11-kilometer) length of coast to the summit of Mauna Loa and the saddle between Mauna Loa and Mauna Kea. All rocks within the aquifer sector belong to Ka‘ū Basalt. The total length of the sector is 37 miles (60 kilometer) from the coast to the saddle, the first 18 miles (29 kilometer) of which is a narrow corridor between the Hualālai and Mauna Kea volcanoes. The width of the corridor is about 5 miles (8 kilometer). High-level groundwater likely occurs at elevations greater than 1,200 feet (366 meters), although this has not been shown yet (Mink and Lau 1993). The basal lens, extending about 4 to 5 miles (6 to 8 kilometers) inland, is brackish except possibly near the inland periphery. Basal springs and anchialine ponds are common along the coast (Mink and Lau 1993).

Few data are available to evaluate groundwater conditions at PTA. Most of the USGS groundwater sampling and observation wells on the island are located along the coast. Groundwater has not been found at levels lower than 1,000 feet (305 meters) below ground level on the island of Hawai‘i (USARHAW and 25th ID[L] 2001b). The island of Hawai‘i contains high water levels in the rift zones of Kilauēa and Kohala volcanoes. High-level groundwater (perched groundwater) is groundwater that is held at levels above the basal water table by rocks that are relatively impermeable, including intrusive rocks, ash beds, dense lava flows, soil, alluvium, and ice. High water levels, possibly associated with a buried rift zone of Hualālai Volcano or fault scarps draped with lava flows, are present along the western coast of the island of Hawai‘i. Areas of high water levels also are found along the northern and eastern flanks of the Mauna Kea and on the southern flank of Mauna Loa (USGS 2000b). There is evidence of perched groundwater within the aquifer sectors underlying and adjacent to PTA (Stearns and McDonald 1946). The highest perched water in the Hawaiian Islands is Lake Waiau on Mauna Kea, at an altitude of 13,007 feet (3,965 meters). It is thought that the lake is perched on ground ice (Stearns and MacDonald 1946).

Based on regional hydrogeological information, it is believed that the groundwater beneath PTA occurs primarily as deep basal water within the older Pleistocene age basalts (USACE 1997). Exploratory well drilling was conducted in March 1965 by the Department of Land and Natural Resources near the PTA cantonment area. A test hole, (Pōhakuloa test hole T-20) located half a mile west of Mauna Kea State Park at an elevation of 6,375 feet (1,943 meters) msl, was drilled to a depth of 1,001 feet (305 meters) below ground surface (bgs). No groundwater was encountered in this test hole (USACE 1997).

Groundwater Quality

There are limited data for groundwater quality for PTA due to the absence of a significant number of monitoring wells in the inland area of the island. In general, the quality of the natural fresh water in Hawai‘i’s basaltic aquifers is considered to be good (Lau 1983). Groundwater quality is threatened by saltwater encroachment and contamination from agricultural and other land uses. Fertilizers and pesticides applied to crops can move downward through the unsaturated zone to an aquifer and affect the quality of the water in the aquifer. Wastes from septic tank systems, sewers, industry, and storm runoff also can introduce undesirable constituents into the aquifers (USGS 2000b). Since the early 1980s, organic chemical contaminants associated with agricultural, industrial, and urban activities have been detected in water samples taken from wells on the island of Hawai‘i. The herbicides atrazine and ametryn, which are associated with sugercane cultivation, have been detected in wells within or downgradient of past and present sugercane cultivation operations on the island of Hawai‘i (USGS 2000b).

Salt water intrusion, particularly along the coast, also threatens groundwater quality. Groundwater withdrawals induce upward and landward movement of saltwater. Wells pumped in the freshwater lens near the coast are particularly likely to induce brackish water or saltwater to move into the well as pumping continues. Larger islands such as Hawai‘i are less affected by saltwater intrusion than the smaller islands due to larger quantities of rainfall for recharge (USGS 1999b).

Since August 1989, the State Department of Health has issued the “Groundwater Contamination Maps” for Hawai‘i. These maps identify locations where groundwater contaminants have been detected and confirmed. The maps identify the locations of current and historic contaminated wells and wellfields (an area where many wells in proximity share the same groundwater source) on each island. According to these maps, most of the well locations where contamination is detected on the island of Hawai‘i are located along the eastern coast of the island. Groundwater quality on the island generally diminishes towards the coasts due to increased saltwater intrusion. Detected contamination levels reported in the State DOH maps are below existing federal and state drinking water standards established for the protection of public health and do not pose a significant risk to humans (HDOH 1999b). Groundwater quality beneath PTA is likely of higher quality due to its distance inland from the coast.

8.8.2 Environmental Consequences

Summary of Impacts

Under the Proposed Action, there would be less than significant impacts on surface water quality at Kawaihae Harbor, on surface and groundwater quality at PTA, and on surface water quality from construction of PTA Trail. Additionally, there would be less than significant impacts on surface water or groundwater from maneuver training at the WPAA or construction of stream crossings as part of PTA Trail. Without the project, training would continue to disturb soils and result in residues of explosives in soils. However, due to lack of permanent surface water resources, and the great depth to groundwater, water quality impacts, if any, are not expected to be significant.

Under the Proposed Action, RLA Alternative, and No Action Alternative there would be less than significant impacts to water resources. These impacts are described in Table 8-17.

Proposed Action (Preferred Alternative)

Less than Significant Impacts

Surface water quality at Kawaihae Harbor. The loading and unloading activities planned under the Proposed Action would be similar to the activities that currently take place as part of the Legacy Force training and that would continue under the No Action Alternative. The Army and the operator of the harbor are responsible for preventing spills and for cleaning them up

Table 8-17
Summary of Potential Water Resources Impacts at PTA

Impact Issues	Proposed Action	Reduced Land Acquisition	No Action
Impacts to surface water quality	⊙	⊙	⊙
Impacts to groundwater quality	⊙	⊙	○
Increased flooding	○	○	○
Groundwater supply	○	○	○

In cases when there would be both beneficial and adverse impacts, both are shown on this table. Mitigation measures would only apply to adverse impacts.

LEGEND:

⊗	= Significant	+	=	Beneficial impact
⃠	= Significant but mitigable to less than significant	N/A	=	Not applicable
⊙	= Less than significant			
○	= No impact			

if they occur, according to standard spill prevention and response procedures. Therefore, these activities are not expected to result in any significant impacts on the water quality in Kawaihae Harbor. Similarly, construction and use of the PTA Trail is not expected to result in significant impacts on surface water in or adjacent to the harbor because spills and erosion would be addressed by implementing construction BMPs and standard spill prevention and response procedures.

Surface water and groundwater quality at PTA. The Proposed Action may increase the amount of explosives residues in soils. It also may result in dispersion of these residues by wind and water erosion. However, due to lack of any permanent streams or water bodies, impacts on surface water would be of short duration, if they occurred, and are not expected to be significant. Due to the depth of groundwater beneath the PTA and the relatively low concentrations of explosives residues in soils, groundwater beneath the PTA is not expected to be affected.

Construction of PTA Trail. During construction of the PTA Trail, soils may be exposed to stormwater runoff, which may enhance erosion. However, using construction BMPs to control runoff would minimize erosion, and the impacts would not be significant on surface water because there are no perennial streams in the project area. Under natural conditions, the intermittent streams carry large amounts of sediment, and a small amount of additional sediment, if it were present because of construction activities, would not be significant.

Maneuver Training on the WPAA. Maneuver training activities in the WPAA may introduce explosives residues in these soils. However, as described above for the rest of PTA, no significant impacts on surface water or groundwater are expected.

Stream Crossings. The construction of PTA Trail could potentially impact waters of the US via the crossing of Waikoloa Stream near the rock wall, about six miles east of Kawaihae Harbor, and about one-half mile south of Highway 19. All stream crossings would be reviewed by the Corps of Engineers prior to construction to determine if the activity is regulated under Section 404 of the Clean Water Act (Section 404). In accordance with Section 404 of the Clean Water Act, any dredge or fill activities in these streams associated with the crossings may require a Department of the Army permit. If a Department of the Army permit is required, then a CWA Section 401 Water Quality Certification issued by Hawai'i also may be required. The Army would design the stream crossings to minimize any dredge or fill impacts to the stream to the fullest extent practicable in compliance with Section 404. If the Corps determines that a Department of the Army permit is required, the Army would abide by all appropriate CWA regulations and permit processes administered by the Corps and Hawai'i.

Reduced Land Acquisition Alternative

Under the RLA Alternative most of the impacts identified under the Proposed Action also would occur. However, under the RLA Alternative, the QTR2 range would be sited at PTA instead of at the SBMR. Construction of QTR2 would result in soil disturbance that could affect surface water quality. However, due to lack of perennial streams at PTA, and the use of construction BMPs to prevent storm water pollution from migrating from the construction area, these impacts are not expected to be significant.

No Action Alternative

Less than Significant Impacts

Surface water quality. Current training activities have resulted in soil contamination at firing points and ranges within the boundaries of the PTA. Section 8.9 includes a discussion of the results of recent soil sampling at the PTA. The most significant explosive constituent found in soils was RDX. Several metals, including iron and aluminum, occur naturally at concentrations above USEPA PRGs for soils. The concentrations of some other metals, including zinc and lead, which were found above soil PRGs, may be attributable in part to training activities.

Under natural conditions, explosives would be expected to degrade over time with exposure to atmospheric oxygen, moisture, sunlight, and microbes in the soil. The fate and transport of metals depends on chemical reactions in the soil that determine whether the metals form compounds that precipitate or dissolve in water or bind to the surface of soil particles.

While complex chemical speciation models and chemical transport models can provide estimates of the rates of migration of metals from soils to surface water or groundwater, direct measurement of concentrations in surface or groundwater are nearly always needed to verify the model results.

At PTA, no surface water samples have been collected, and there are no perennial streams, so the ultimate result of the interaction of chemicals in soils with intermittent surface water runoff would be to transport the chemicals with the intermittent stream flows and sediment and deposit them downslope. No significant impacts on surface water quality are expected, as described above, because surface water is present only intermittently, following large storms.

Infiltration and percolation of surface water could dissolve and transport chemicals deposited in surface soils to the subsurface. However, with a few exceptions, most of the mass of chemical residues are expected to dissolve relatively slowly in water and would remain in shallow soils. It would require large volumes of recharge to carry dissolved contaminants to the great depths at which groundwater may occur beneath the PTA and relatively long time periods for the chemicals to be transported. Even if relatively soluble compounds, such as perchlorate, were transported with the recharge, the concentrations would be very dilute when they arrived at the depth of basal groundwater (provided it is present beneath the PTA). There are no groundwater wells in the area, and therefore no groundwater monitoring has been performed to confirm that groundwater beneath the PTA has not been affected by chemical contaminants. However, groundwater is not used locally as a source of drinking water, so there are no receptors in the area who would be impacted if trace constituents were to reach the groundwater aquifer. For these reasons, no significant impacts are expected on groundwater resources from chemicals generated by legacy force training or construction activities under the No Action Alternative.

Plants and animals may be affected by explosives residues in ponded water or in moisture retained in soils. Thus, explosives residues in the stormwater, even if not considered a significant impact on surface or groundwater used by humans, may have an effect on other environmental receptors. The potential effects on flora and fauna are described further in the discussion of biological impacts in Section 9.10.

No water quality impacts are expected from continued Army use of facilities at Kawaihae Harbor under the No Action Alternative.